ESTO

Earth Science Technology Office

FLEXIBLE T/R MEMBRANE FOR LARGE APERTURE SCANNING ANTENNAS

Current phased array antennas are rigid, bulky, costly, and generally confined to low Earth orbit. Scientific measurement requirements for larger, higher orbit antennas necessitate a new approach. One solution may be a membrane-based instrument.

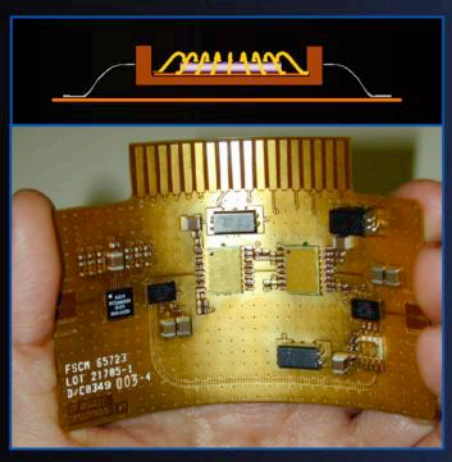
How it Works

Flexible, thin-film membrane antennas can dramatically reduce the weight, volume, and associated cost of space-based radars by replacing conventional rigid manifold antenna architectures.

The primary challenge of an active membrane array is to develop transmit/receive (T/R) modules that are compatible with, and can be reliably integrated with the thin membrane (in this case a 2 mil Polyimide). Several approaches are being pursued.

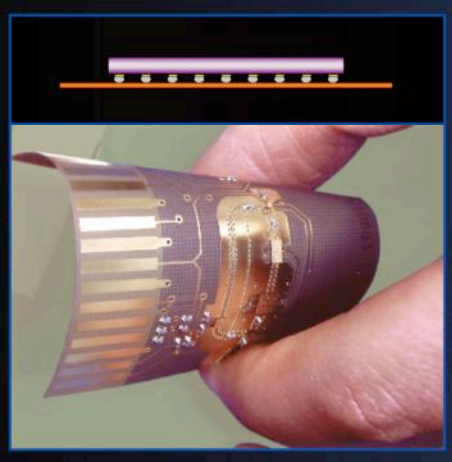
Approach 1

T/R module using packaged components: In this approach to achieve optimum flexibility, surface mount T/R components were attached directly to the membrane. This is in lieu of packaging the T/R module components inside a bulky package and then attaching the package to the membrane.



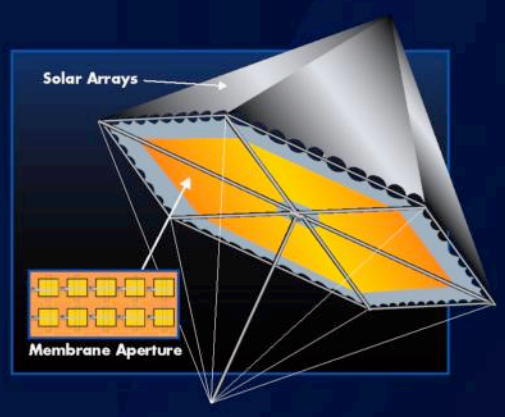
Approach 2

T/R module using bare die: In this method flip chip attachment of bare die onto the membrane is used. This could potentially increase the reliability of module/substrate integration by eliminating one layer of interconnects. The short signal paths of a flip chip design would reduce parasitics compared to other methods such as wire bond approach. In addition, the low profile flip chip configuration would only improve the flexibility of the assembly.



Features and Benefits

- Lightweight (<2kg/m^2 vs. >20kg/m^2) and high antenna packaging efficiency
- Lower launch cost due to low weight and reduced volume of stowed antenna
- Enables very large, electronically steerable apertures that can be placed in high orbits (MEO & GEO) for instantaneous accessibility



Future Applications

- Synthetic Aperture Radar (SAR) measurements in areas such as:
  - 3-D surface deformation and strain measurement in connection with seismic and volcanic activity
  - Natural and manmade hazard monitoring, assessment, and disaster response
  - Land cover change, soil moisture, ocean circulation, and ice motion
- Spin-off applications such as conformal sensors and electronics for airplane wings or flexible microchips for high-tech clothing

Acknowledgments

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Funding by the Earth Science Technology Office (ESTO) as an Advanced Component Technology

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